

Reported practices on ventilative cooling and perceived overheating in *low-energy* homes

Presented at
venticool & AIVC Advisory Board of Practitioners
meeting n.12: Drivers and Barriers for resilient ventilative cooling
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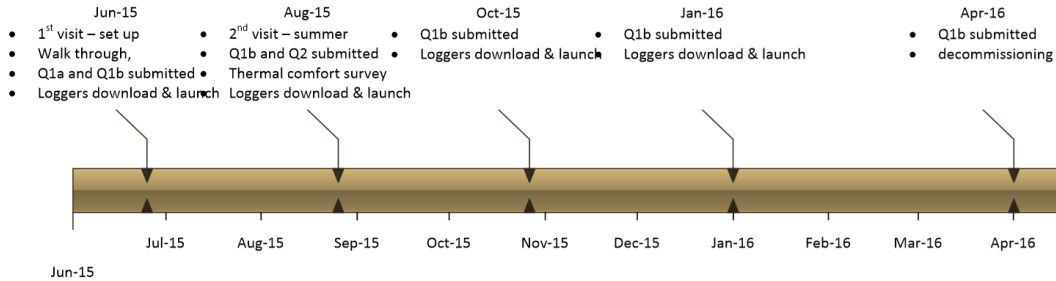
1. Context and case studies




Post occupancy evaluation (diagnostic POE)

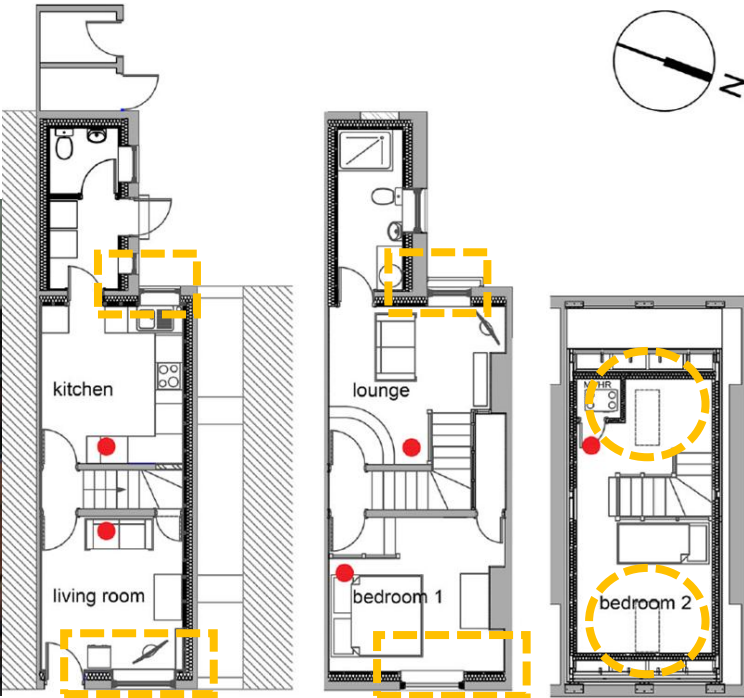
Longitudinal study (over 11 months)

Environmental monitoring + occupant perspective




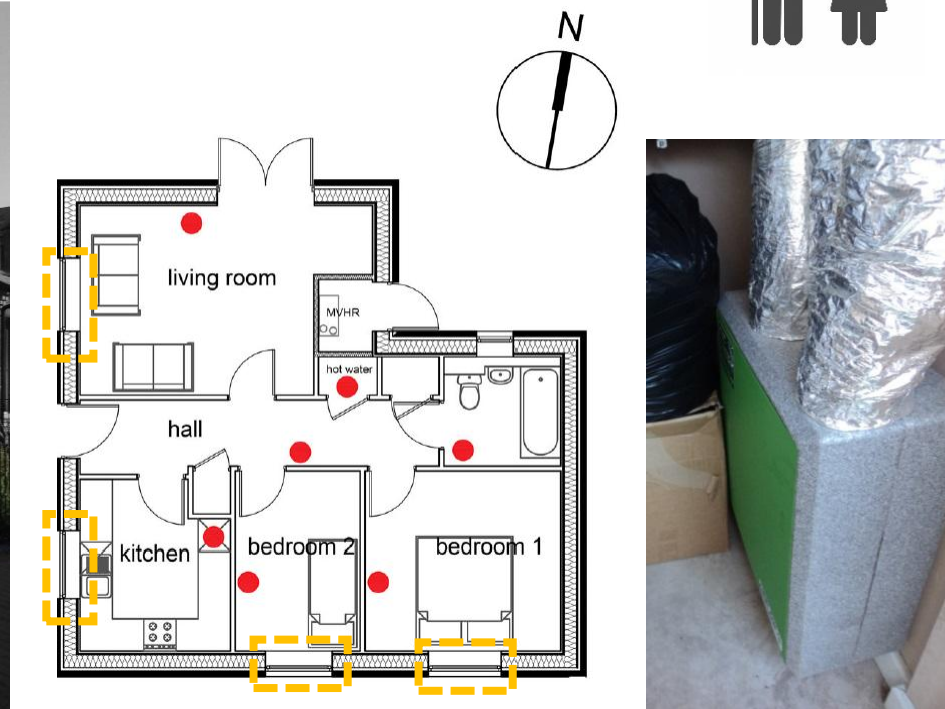
1. Context and case studies

House UK51	context	Design standard	U-value ext. walls	Solar gains	Thermal mass	Ventilation	Occupancy
RETROFIT	urban	Passivhaus (EnerPhit)	0.12 W/m ² K	E & W	No (internally insulated)	-cross vent. -MVHR (no bypass)	




1. Context and case studies

House UK52	context	Design standard	U-value ext. walls	Solar gains	Thermal mass	Ventilation	Occupancy
NEW	suburban	Passivhaus development	0.09 W/m ² K	O & S	no	-cross vent. -MVHR (no bypass)	

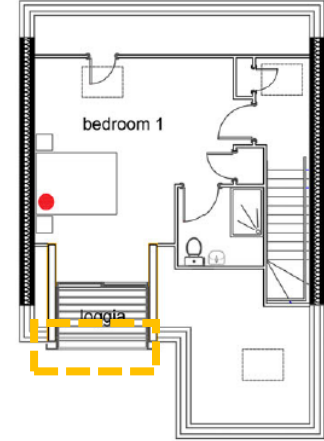
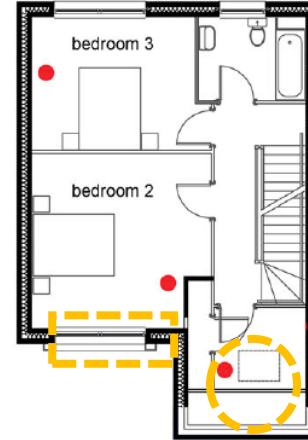
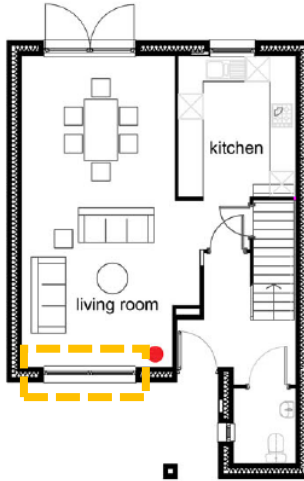


1. Context and case studies


House UK54	context	Design standard	U-value ext. walls	Solar gains	Thermal mass	Ventilation	Occupancy
NEW	suburban	Improved Build. Regs.	0.19 W/m ² K	N & S	yes	-cross vent. -MEV	

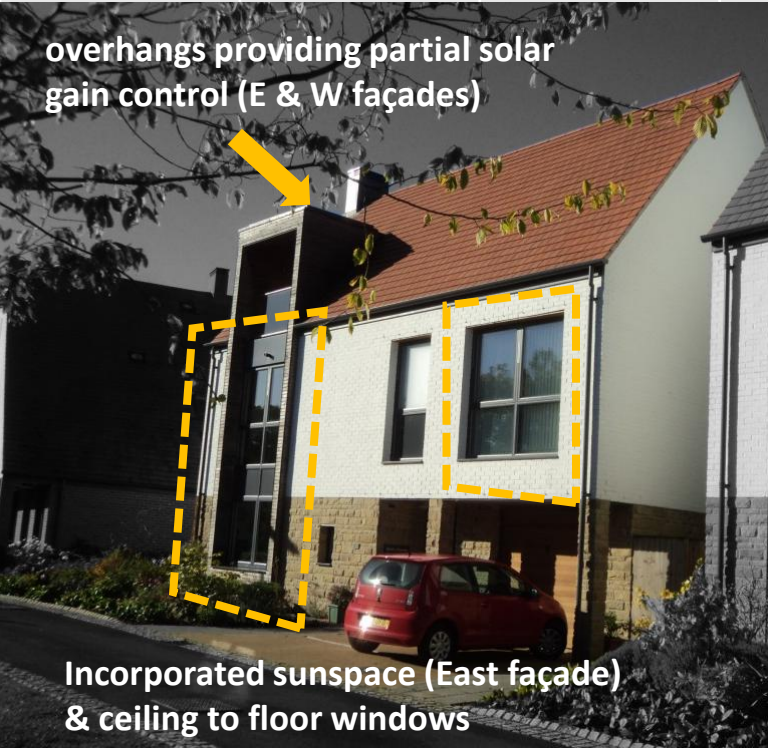


Incorporated overhangs providing partial solar gain control (south façade)



1. Context and case studies

House UK55	context	Design standard	U-value ext. walls	Solar gains	Thermal mass	Ventilation	Occupancy
NEW	suburban	Improved Build. Regs.	0.19 W/m ² K	E W & S	yes	-cross vent. -MVHR (no bypass)	



2. Results – longitudinal questionnaire

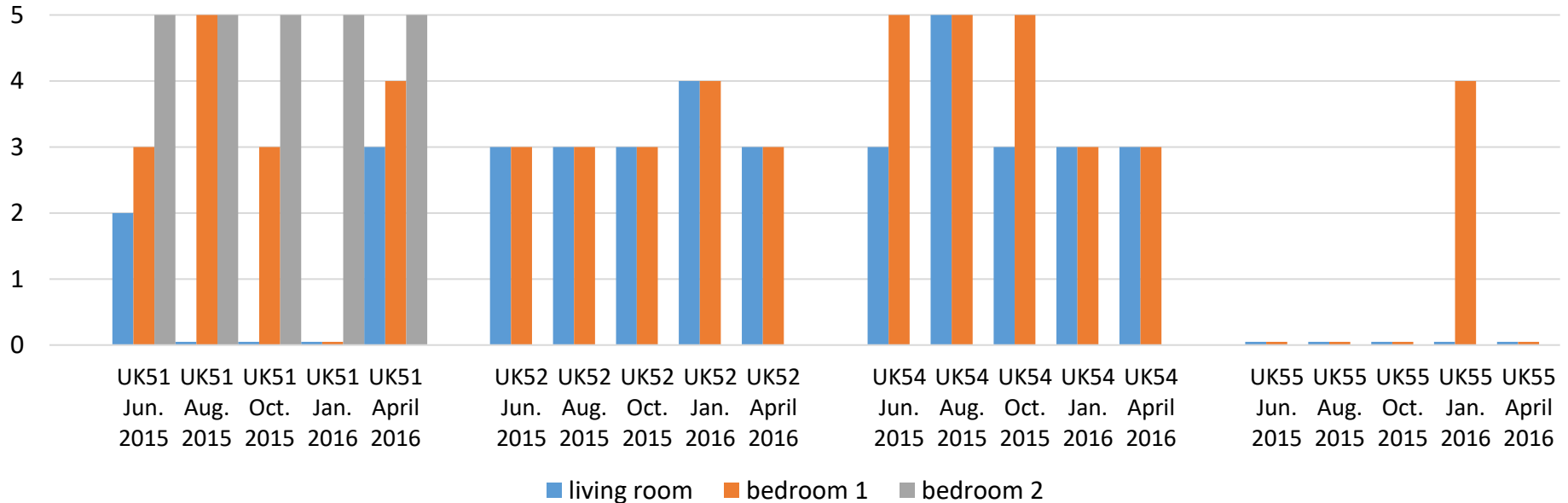


Q1, question 13: *"During this time of the year, do you find it difficult to keep comfortably cool any room? Please specify time slot."*

	UK51					UK52					UK54					UK55				
	Jun.15	Aug.15	Oct.15	Jan.16	Apr.16	Jun.15	Aug.15	Oct.15	Jan.16	Apr.16	Jun.15	Aug.15	Oct.15	Jan.16	Apr.16	Jun.15	Aug.15	Oct.15	Jan.16	Apr.16
living room	-	-	-	-	18-22	-	9-16	-	-	14-16	-	-	-	-	-	-	-	-	-	-
kitchen	-	-	-	-	16-22	-	-	-	-	14-16	-	-	-	-	-	-	-	18-20	-	-
hall						0-24	0-24	0-24	0-24	20-22	-	-	-	-	-	-	-	-	0-24	-
bathroom (ground floor)						-	-	-	-	14-16	-	-	-	-	-	-	-	-	-	-
bathroom (first floor)	-	-	-	-	18-22						-	-	-	-	-	-	-	-	-	-
bedroom 1 (main)	-	-	-	-	18-22	-	20-8	-	24-8	20-22	-	-	-	-	-	-	14-18	-	-	22-8
bedroom 2	18-24	12-20	24-6	-	14-18	-	20-8	-	24-8	20-22	-	-	-	-	-	-	-	-	-	22-8
bed 3 or lounge	-	-	-	-	-						-	-	-	-	-	-	-	-	-	-
office											11-17	11-17	-	-	-	-	8-12	-	-	-

2. Results – longitudinal questionnaire

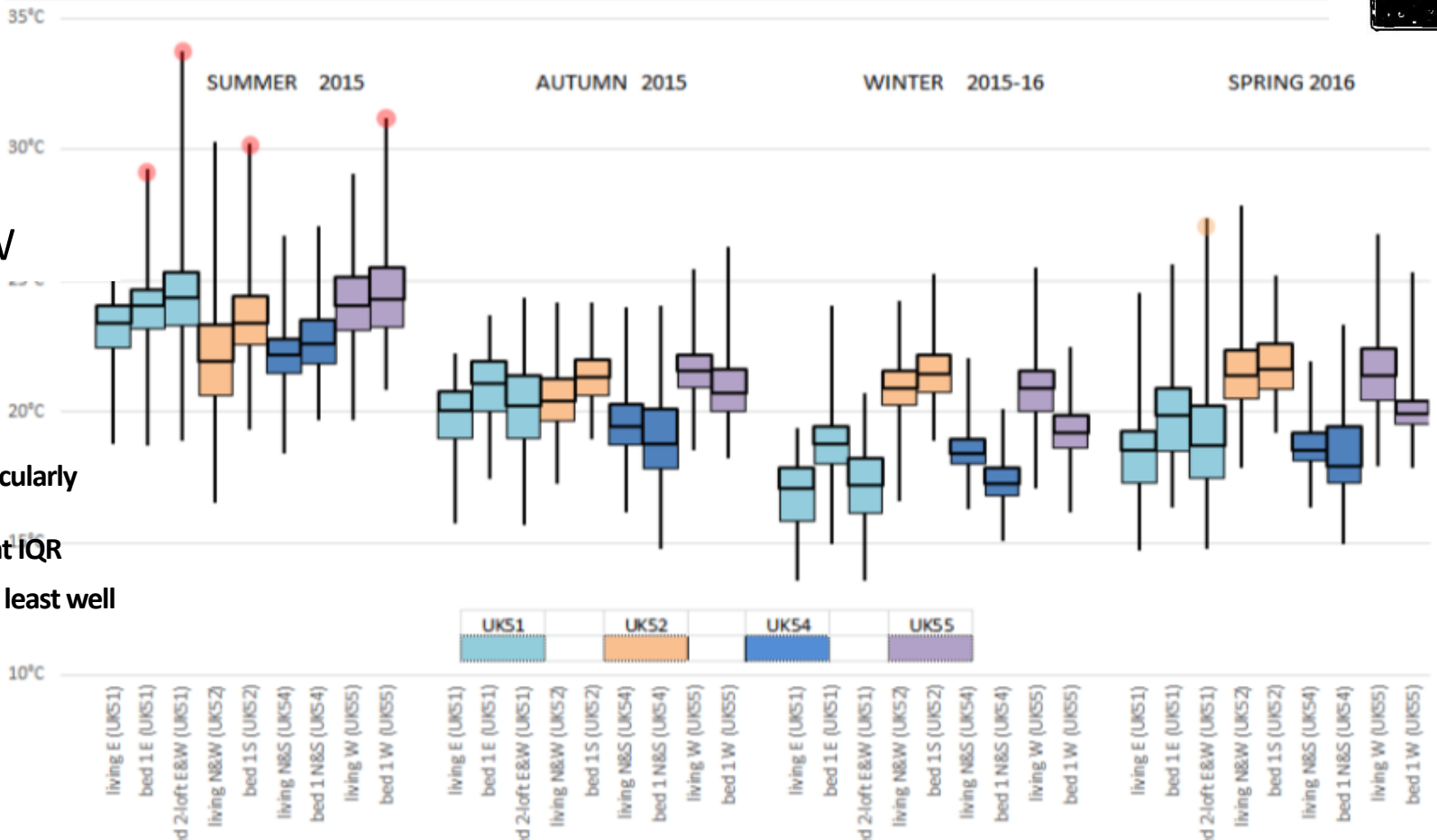
Q1 - question 10: "How often do you open the windows in order to cool a room?"
(never=0, rarely=1, weekly=2, daily=3, night=4, day&night=5)



2. Results – long term monitoring



YEAR OVERVIEW



- SUMMER particularly different
- UKS2 consistent IQR
- Refurbishment least well performing

3. Reported practices on ventilation



Window opening

Common adaptive strategy: most occupants opened windows day & night, even outside summer.

Restrictions:

- Physical barriers (e.g., inaccessible kitchen window – UK52).
- Security/fear of burglary (ground floor windows – UK51 & UK52).
- Noise disturbance (street – UK51).
- Odours/smoke from outside (UK51).

Misconceptions: In UK55, occupants believed the MVHR alone could provide cooling, so windows remained closed despite overheating.

3. Reported practices on ventilation

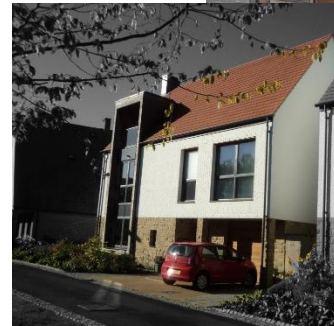


Mechanical ventilation

- MVHR without **summer bypass** in UK51, UK52, UK55 contributed to overheating.
- **Lack of guidance**/house manuals → occupants misunderstood MVHR role in summer cooling.
- UK54 (no MVHR, natural ventilation) + **learned adaptive behaviour** (holiday experience in Mediterranean climates) → successful management of indoor comfort.

4. Perceived overheating

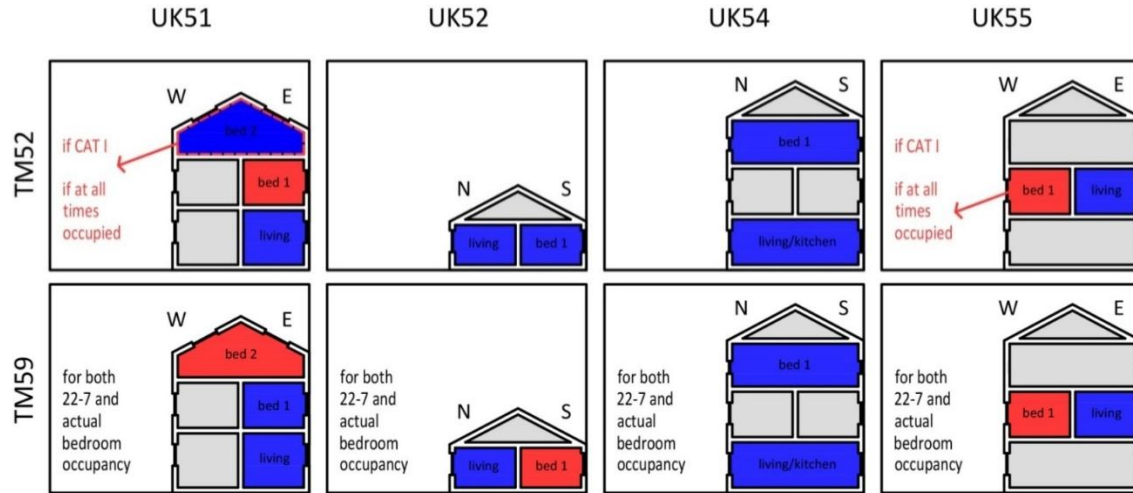
- **UK51 (retrofit with roof pod):** Persistent overheating in loft bedroom despite the roof windows always open; internal blinds on roofs windows were insufficient.
- **UK52 (bungalow):** Bedrooms & hall difficult to keep cool year-round; internal heat gains from hot water cylinder worsened conditions.
- **UK54 (end terrace):** No significant overheating, except temporarily when windows couldn't be opened due to construction works.
- **UK55 (detached with sunspace):** Severe overheating recorded, but occupants did not perceive it due to a neurological condition (vulnerability).



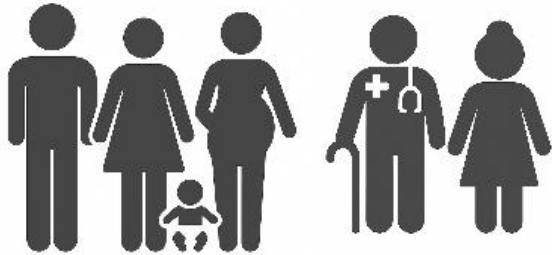
4. Perceived overheating

Key Insights

- **Bedrooms** most affected (especially upper floors).
- Occupant **perceptions** generally aligned with measured overheating (CIBSE TM59) – except when health conditions limited heat perception.
- **Adaptive practices** (moving to cooler rooms, keeping blinds shut, window opening) sometimes insufficient.



5. Lessons for design and policy



- **Over-reliance on window opening is risky** (noise, safety, pollution, inaccessibility).
- **MVHR requires summer bypass & clear occupant guidance.**
- **Vulnerable occupants** (permanent or temporary) may not perceive or adapt effectively → need stricter design thresholds.
- **Part O of Building Regulations:** does not fully capture overheating risks in retrofits, roof pods, hot water cylinder placement, or sunspaces.

5. Lessons for design and policy



- Ventilative cooling is widely practiced but often constrained by **contextual barriers**.
- Perceived overheating is most acute in **bedrooms**, directly affecting comfort & health.
- **Mismatch** exists between occupant perception, adaptive actions, and design intentions.
- **Robust ventilative cooling strategies need to be designed-in, accessible, safe, and clearly communicated to occupants.**

Reference:

Toledo, L., Wright, A., & Cropper, P. (2025). Case study investigation of overheating in low-energy homes: insights from a post-occupancy evaluation in England. *Building Research & Information*, 1–26.

<https://doi.org/10.1080/09613218.2024.2417274>

Thanks for listening. Any questions?

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